

# (12) UK Patent Application (19) GB (11) 2 279 909 (13) A

(43) Date of A Publication 18.01.1995

(21) Application No 9413301.4

(22) Date of Filing 01.07.1994

(30) Priority Data

(31) 4322027

(32) 02.07.1993

(33) DE

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B41F 27/12

(52) UK CL (Edition N)

B6C CKW C617 C626 C656

(56) Documents Cited

EP 0582903 A

US 5289775 A

(58) Field of Search

UK CL (Edition M) B6C CKW CMB CMC

INT CL<sup>5</sup> B41F 27/00 27/06 27/12 27/14

ONLINE DATABASE : WPI

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## (54) Plate changing in a printing machine

(57) A printing machine incorporates an arrangement for automatic changing of printing plates without requiring an unduly large amount of space or an overly wide plate cylinder channel. Plate holding devices (10 or 11) are each movable between a position spaced from an associated plate cylinder (3 or 4) and a position in operative connection with the cylinder along a rectilinear guide (14 or 15). The guides are pivotable by pneumatic units (29, 30) so that a hooking or unhooking of a printing plate end portion (18 or 19) into or out of the plate cylinder channel (8 or 9) can take place. Each cylinder includes means for the opening of its channel (8 or 9), clamping of the plate end (19) and tensioning of the plate.

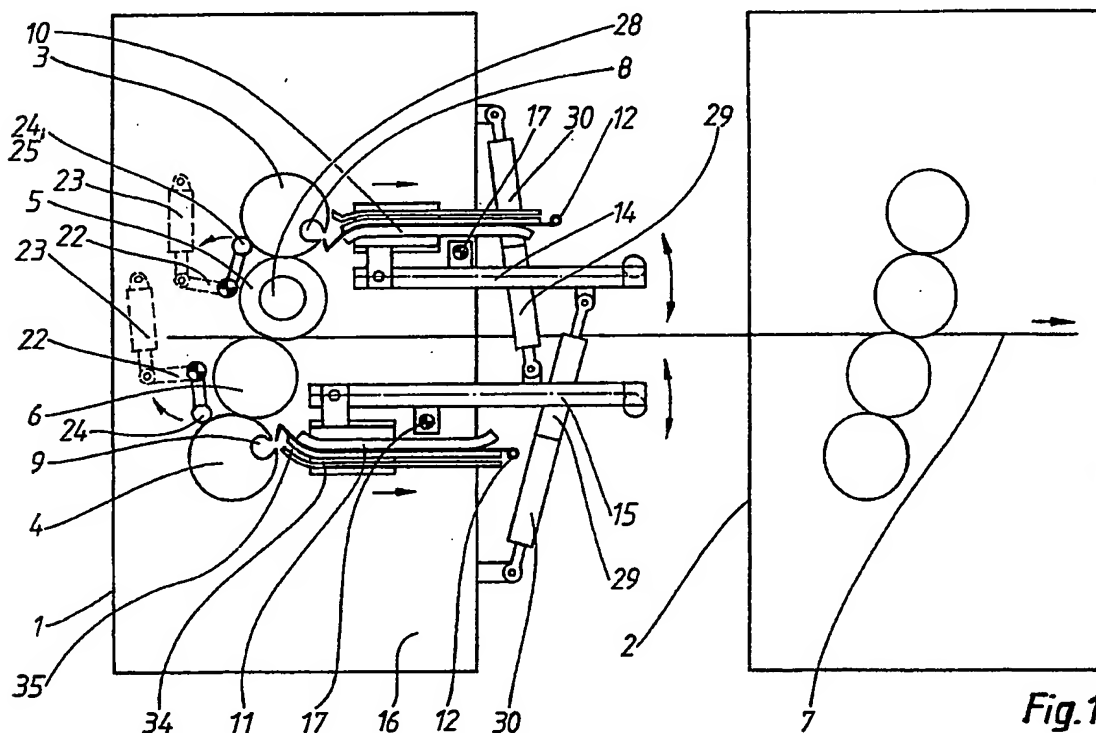


Fig.1

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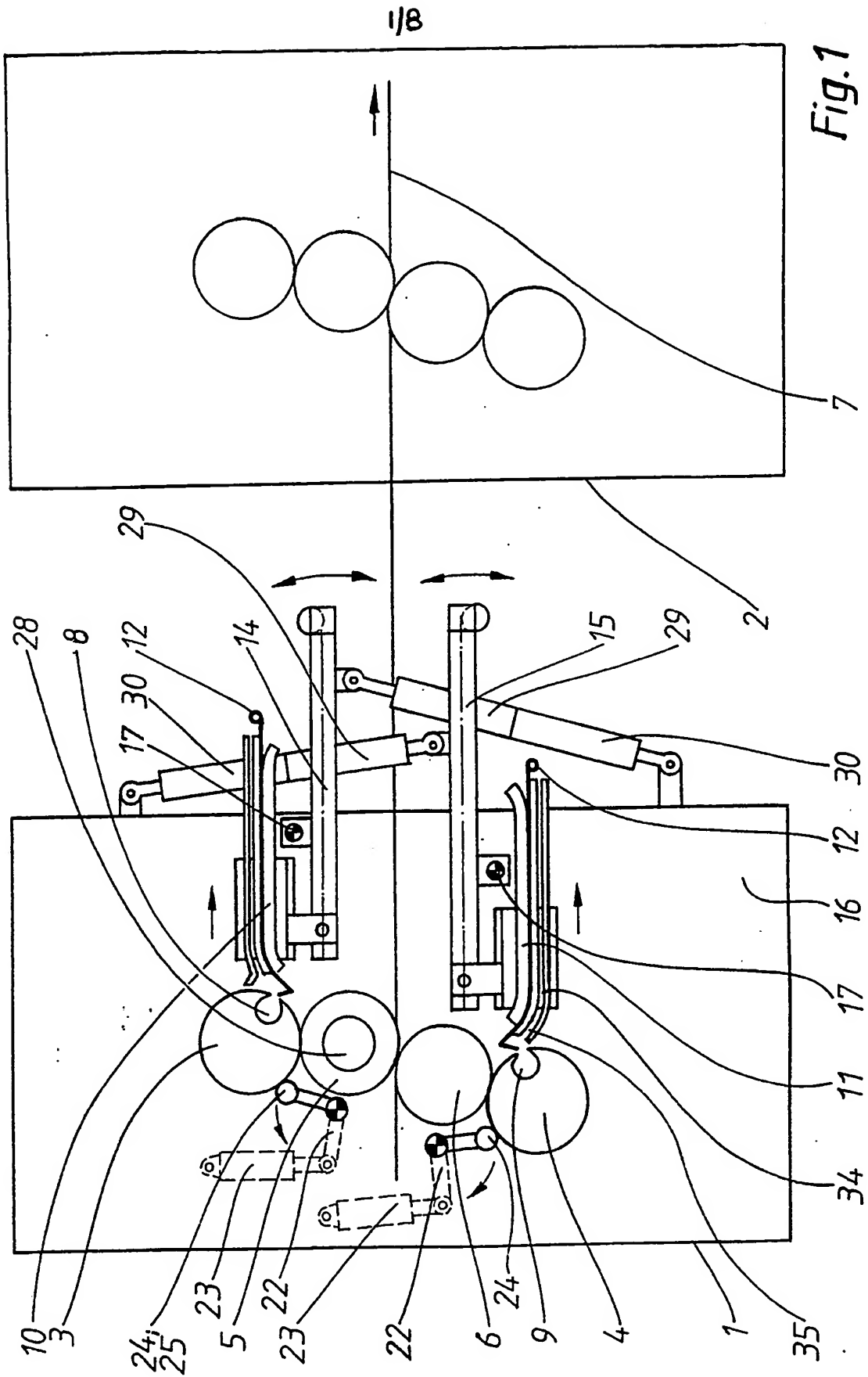


Fig. 1

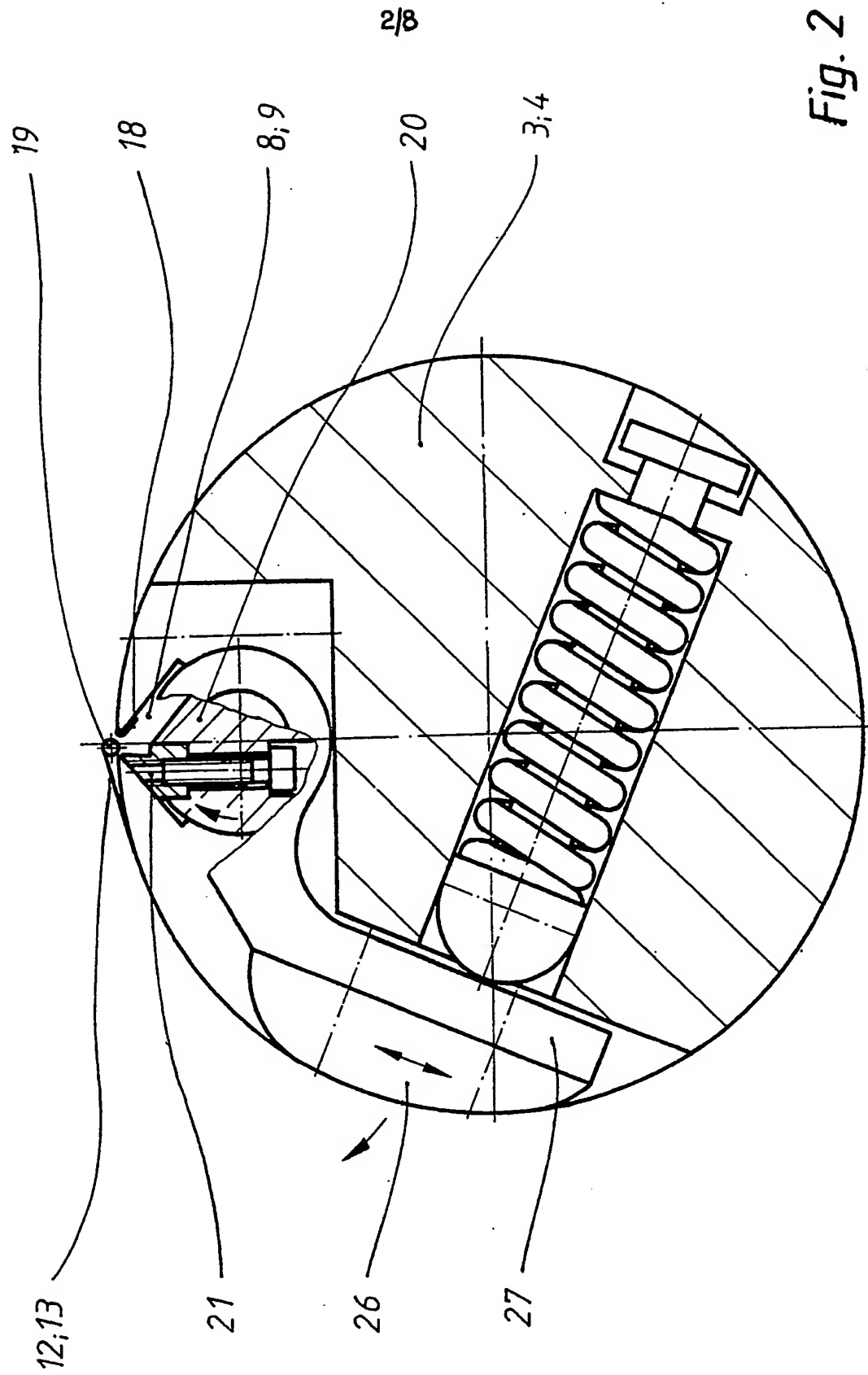


Fig. 2

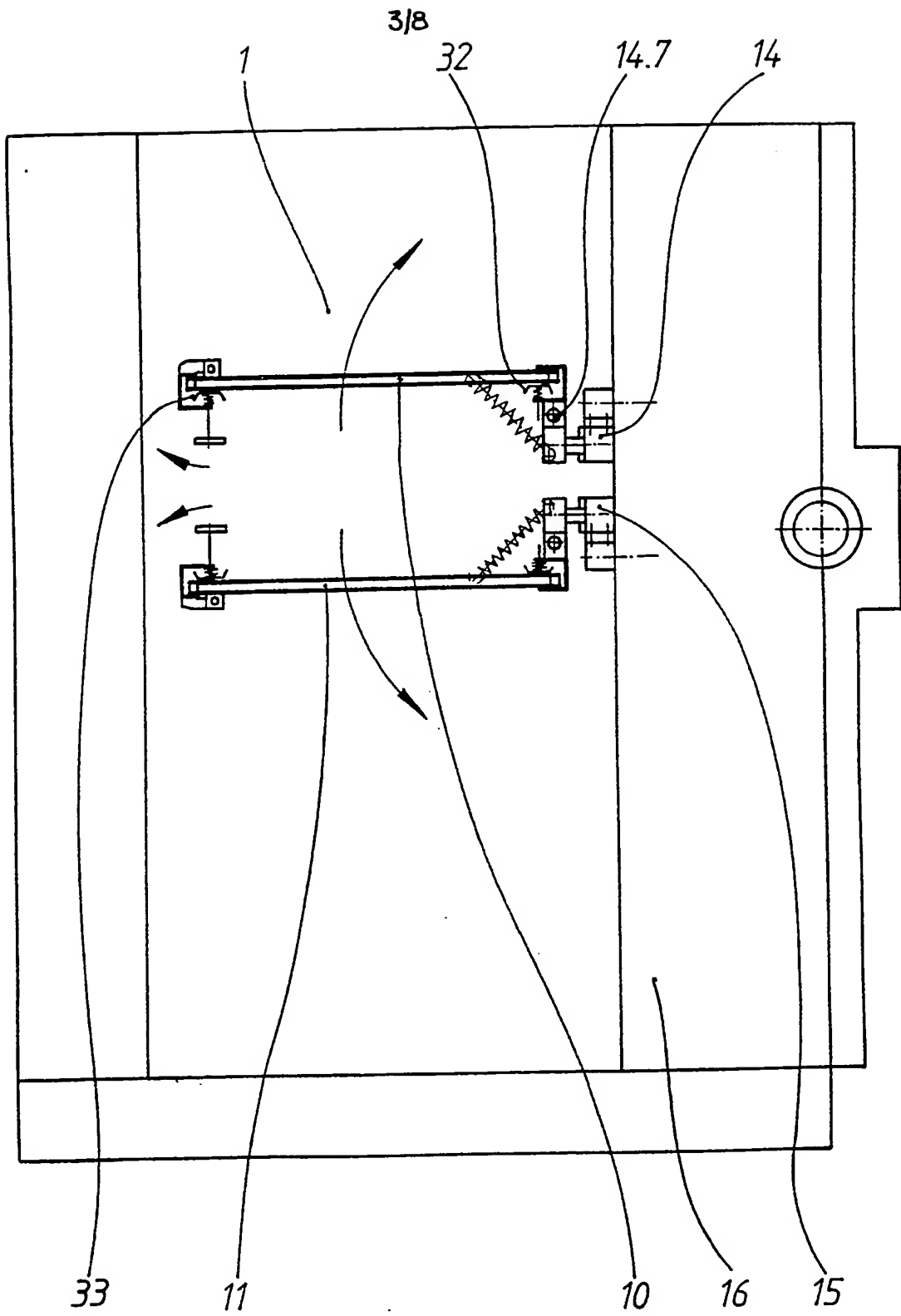
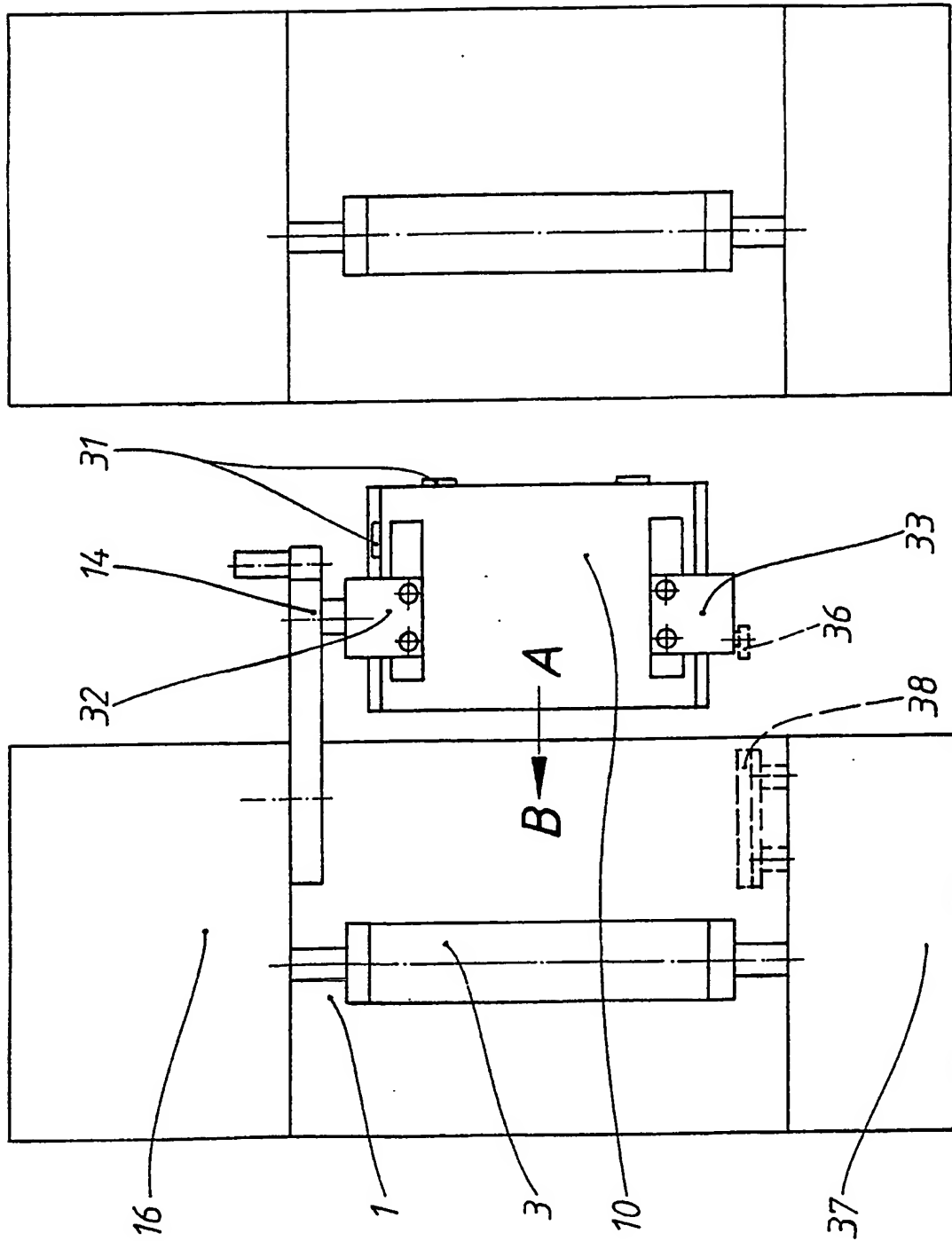


Fig. 3

Fig. 4



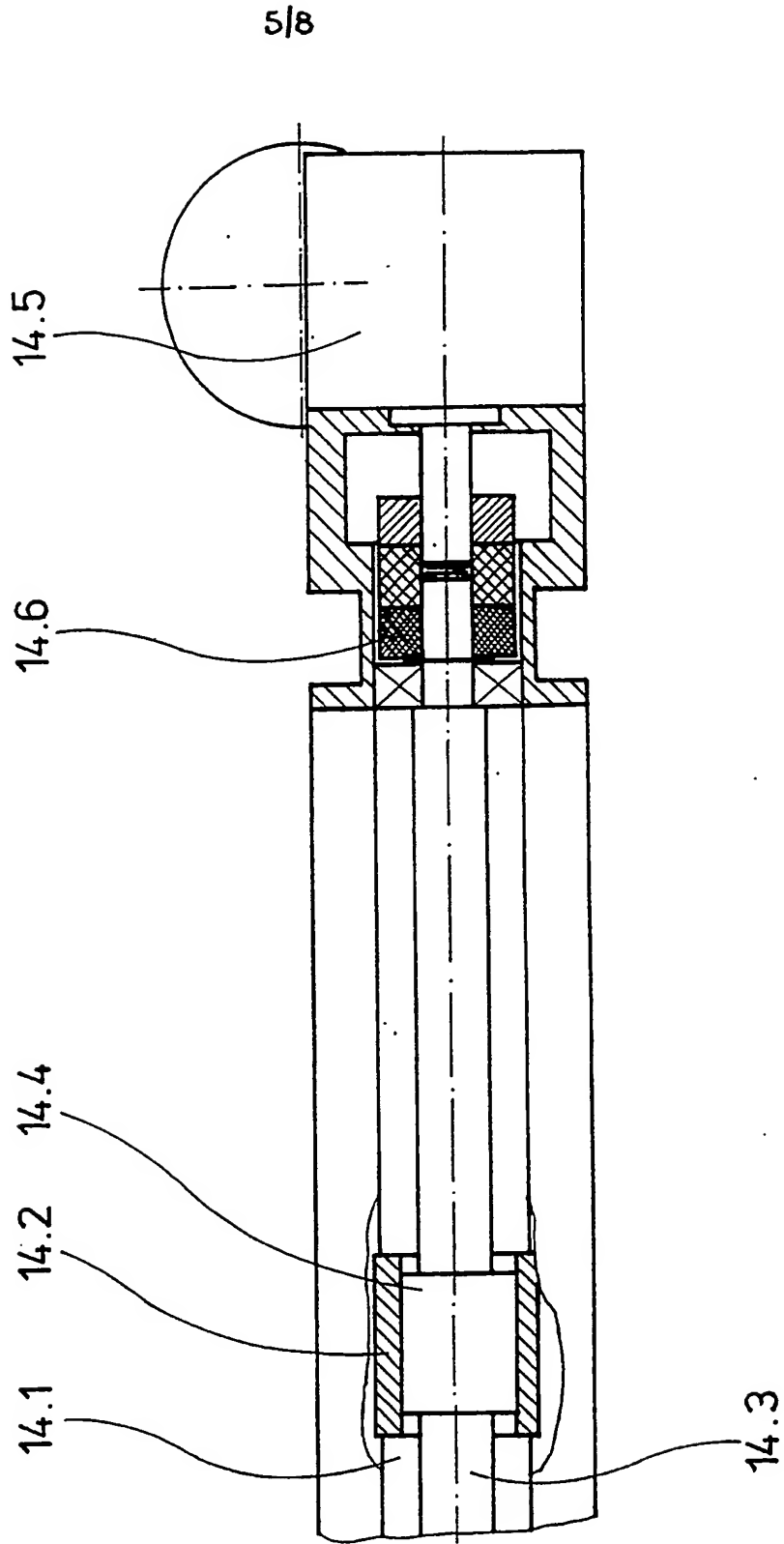


Fig. 5

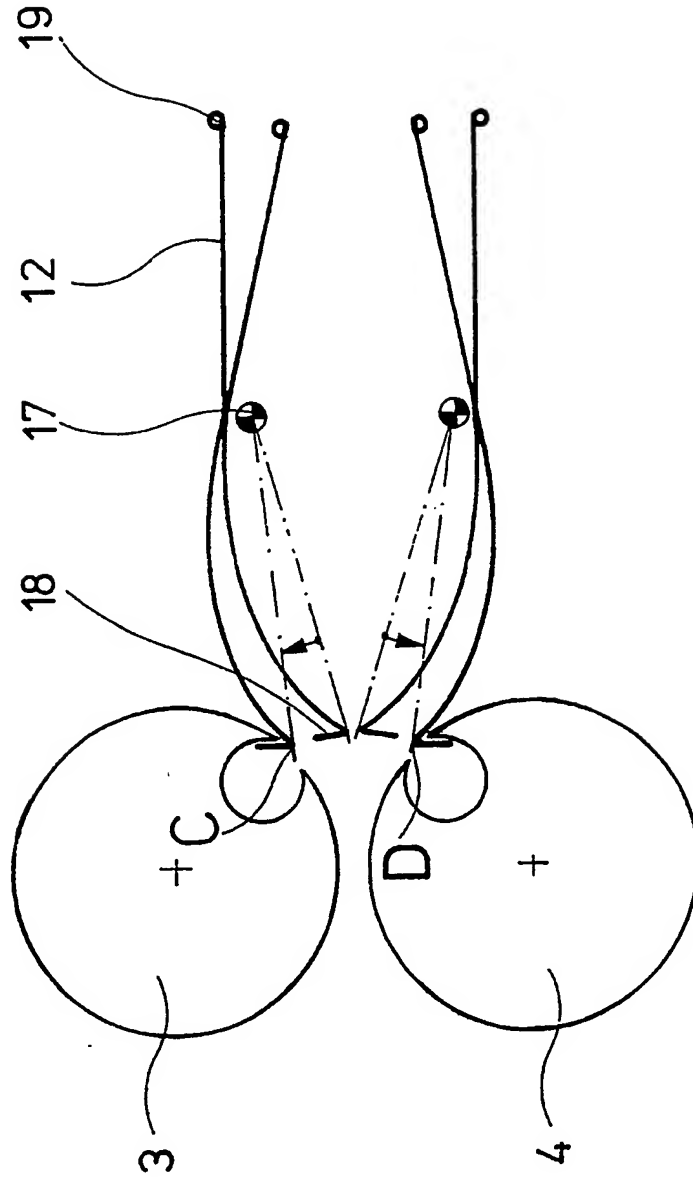


Fig. 6a

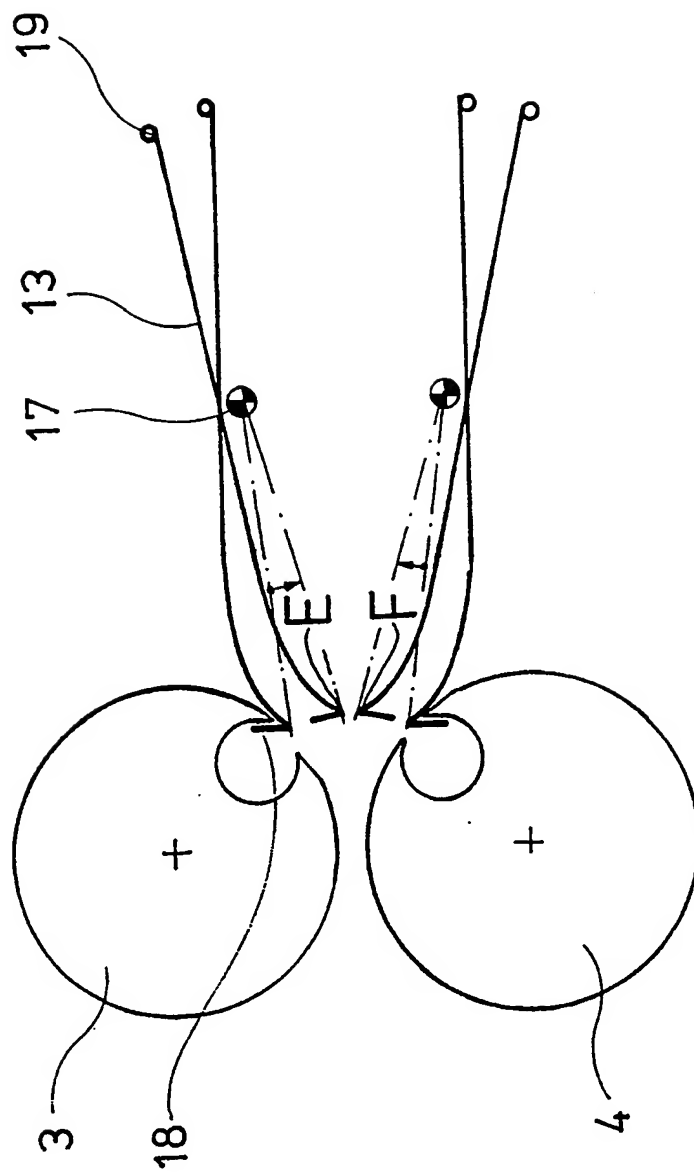


Fig. 6b



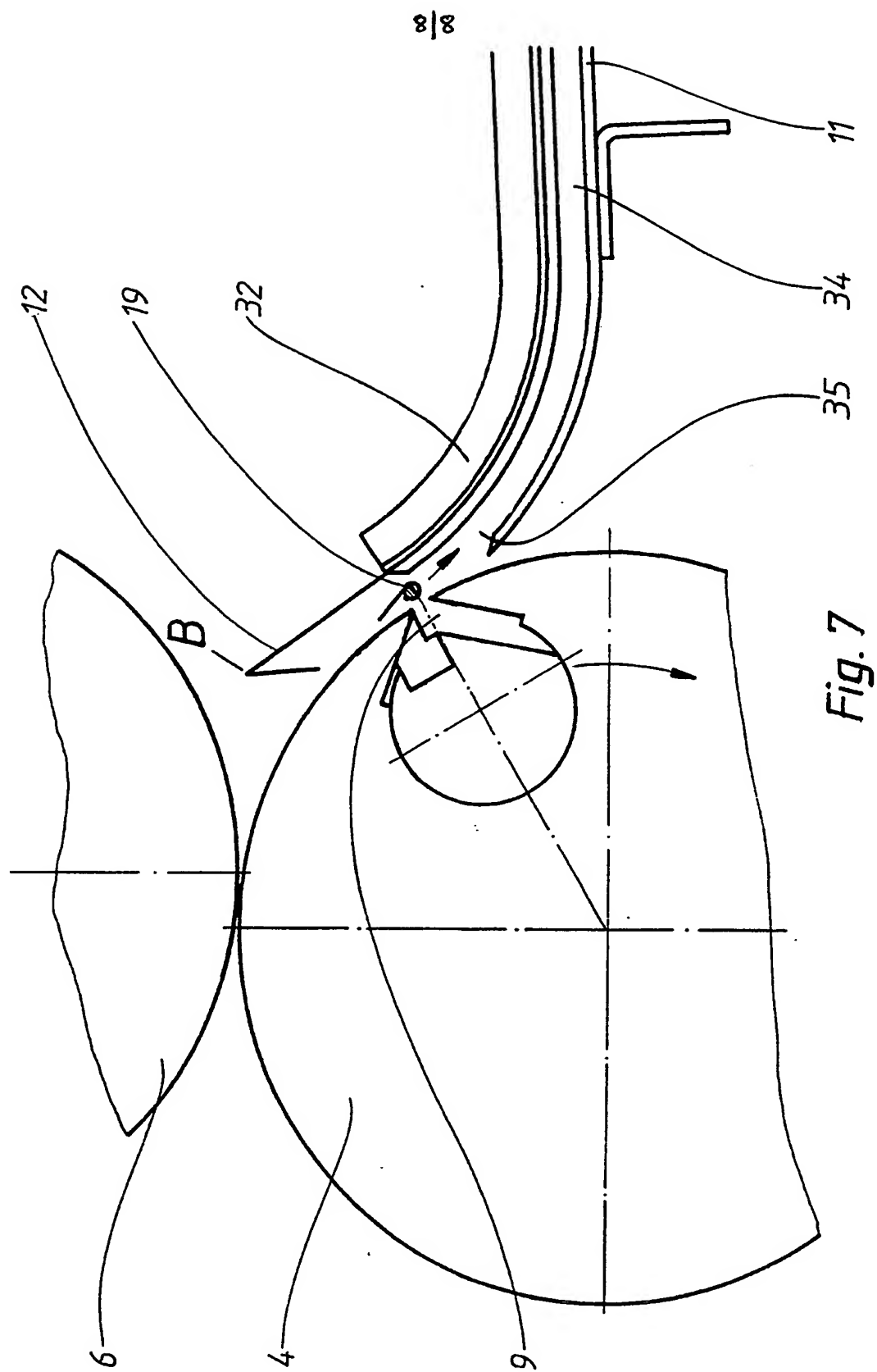


Fig. 7

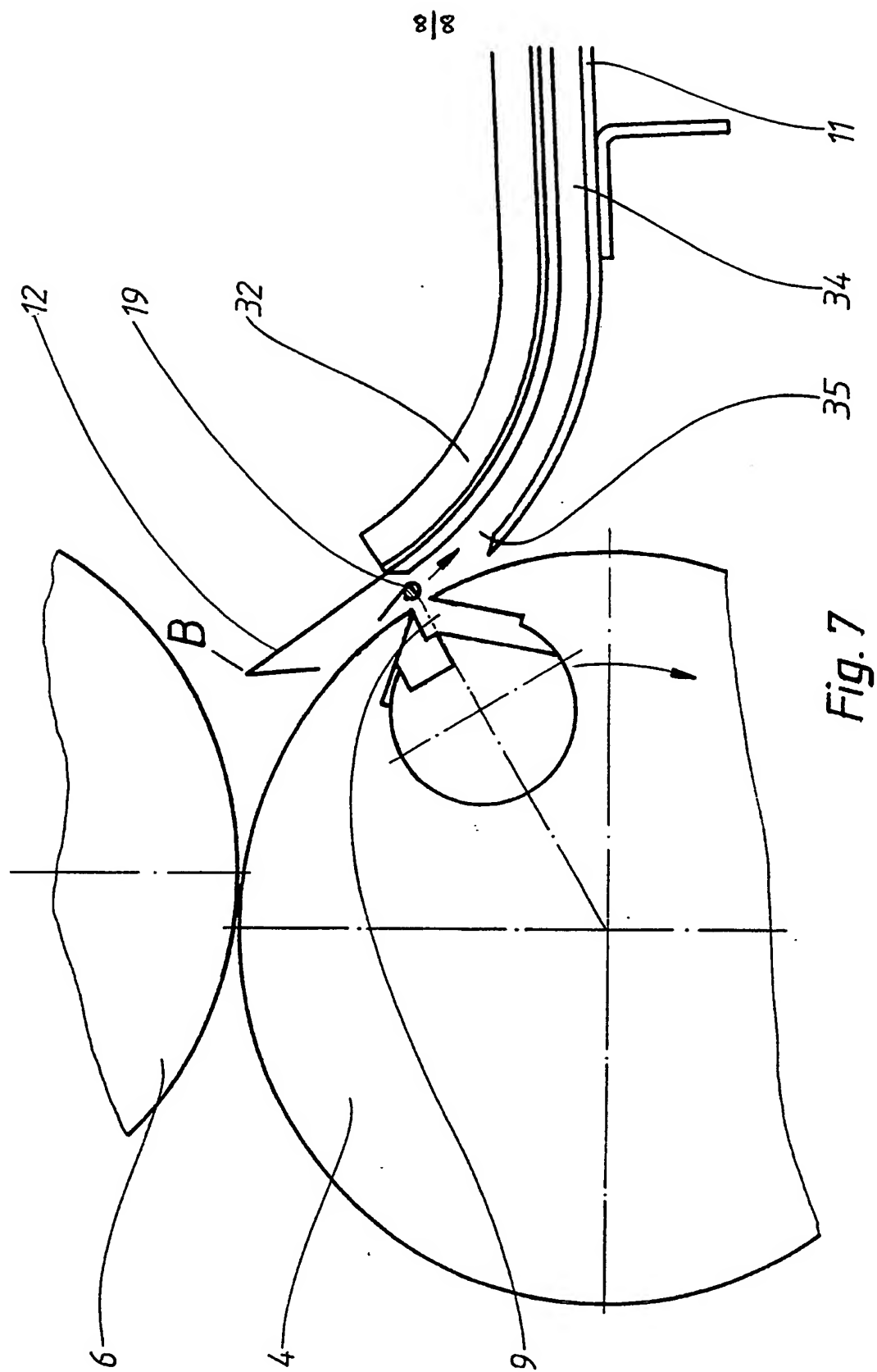


PLATE CHANGING IN A PRINTING MACHINE

The present invention relates to a printing machine and has particular reference to a machine in which automatic changing of printing plates can be carried out.

The disadvantages of manual changing of printing plates are, in particular, that auxiliary personnel are not normally available for this purpose and that the standstill times militate against economic fulfilment of small printing orders, in particular when the printed material strip must also be capped for the purpose of the plate change. The working safety of personnel is also difficult to ensure.

Automatic printing plate changers are known, for example from DE-PS 39 40 796 and DE-OS 40 03 445. It is a disadvantage of the known changers that they depend on a relatively wide plate cylinder channel, thus a relatively wide print-free zone, on the plate cylinder, such as is not available in the case of rotary printing machines of small format. If the plate change for rotary printing machines is to be possible without capping of the printed strip, the known changers are then too demanding in respect of their spatial requirement.

There is thus a need, especially for rotary printing machines of small format with four-cylinder printing units, for a printing plate changing arrangement which is compatible with restricted space conditions and also with narrow cylinder channels.

According to the present invention there is provided means for the automatic changing of a printing plate, preferably for rotary printing machines of small format for offset printing with four-cylinder printing units, wherein automatic changing, machine servicing and normal operation are possible, comprising a respective plate holding device movable out of a first end position at a spacing from each plate cylinder into a second end position in operative connection with the plate cylinder and back again in a rectilinear guide, which is oriented substantially horizontally, extends substantially at right angles to the rotational axis of the cylinder and is mounted at one end in a frame side wall at a drive side, wherein the guide is pivotable by the front part into an upper and a lower position about an axis which is substantially parallel to the rotational axis of the cylinder so that the reception and removal of the printing plate is possible in the first end position and, in the case of an upper plate cylinder, in the second end position a hooking of the printing plate start into a channel of the plate cylinder can be effected through upward pivotation of the guide and unhooking of the printing plate start from the channel can be effected through a downward pivotation, and conversely in the case of a lower plate cylinder, and wherein each plate cylinder comprises a tensioning shaft, which is mounted to be rotatable, with a tensioning strip for the tensioning of a printing plate therearound and that switching and transmission members are provided at the cylinder for opening of the plate cylinder channel, clamping of the printing plate end and tensioning of the plate.

Preferably, actuating rollers, which are rotatably mounted in levers, can be set against the plate cylinders and, when so set, stand in operative connection with switching segments, which are positioned in the circumferential surfaces of the plate cylinder, of  
5 spring-loaded switching levers connected to be rotationally fast with the tensioning shafts.

For preference, detectors are provided for recognition of the position of each guide for hooking in and unhooking of the printing plate start, wherein the cylinder channel in the position for  
10 hooking-in and unhooking of the printing plate start faces the corresponding position of the printing plate start in the pivoted device.

Expediently, the pivotation axis of each guide is so arranged in respect of its geometric location that the bent-over part of the  
15 printing plate start is oriented parallelly to the associated hooking edge of the plate cylinder channel during the hooking-in.

Each plate holding device can be provided with abutments and spring-loaded presser feet for the exact positioning and fixing of printing plates. Further, each device can be pivotably mounted on  
20 the respective guide so as to be pivotable out for servicing, and can be supported by rollers at a frame side wall at an operating side.

For preference, contact pressure rollers, which are rotatably mounted in levers, for the pressing of printing plates during  
25 tensioning thereof are settable against the plate cylinders and the actuating rollers are mounted at the same time on the contact pressure rollers.

An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

- 5                    Fig. 1            is a schematic side elevation of a printing machine comprising a series arrangement of two four-cylinder printing units and a plate changing arrangement associated with each plate cylinder;
- 10                   Fig. 2            is a cross-section, to an enlarged scale, of one of the plate cylinders;
- Fig. 3            is a schematic view, from the rear, of part of the plate changing arrangements;
- Fig. 4            is a schematic plan view of the plate changing arrangements;
- 15                   Fig. 5            is a schematic, partly sectioned side elevation of a part of a guide in one of the plate changing arrangements;
- Fig. 6a           is a diagram showing movement phases in the hooking-in of a printing plate into a channel of a plate cylinder;
- 20                   Fig. 6b           is a diagram showing movement phases in the unhooking of a plate from a channel; and
- Fig. 7            is a schematic view illustrating the detaching of a printing plate end out of a plate cylinder channel.
- 25

Referring now to the drawings, there is shown part of a rotary printing machine comprising a series arrangement of two four-cylinder printing units 1 and 2 each with a respective plate cylinder 3 or 4 and a respective rubber blanket cylinder 5 or 6 for first form and perfecting form printing on a material strip 7. Channels 8 and 9 of the cylinder are indicated to enlarged scale. Respective plate changing means for the automatic changing of printing plates is associated with each of the plate cylinders 3 and 4 of the printing unit 1.

10       The plate changing means comprise plate holding or feed devices 10 and 11 for receiving a new printing plate 12, feeding the new plate 12 to the plate cylinder 3 or 4, taking an old plate 13 off the cylinder 3 or 4 and guiding the old plate 13 away from the cylinder. Each device 10 or 11 is movable out of a first end position A at a spacing from the associated plate cylinder 3 or 4 into a second end position B directly at the cylinder, and back again, in a substantially horizontally oriented rectilinear guide 14 or 15 extending at right angles to the rotational axis of the associated plate cylinder.

20       Each guide 14 or 15 is mounted at one end in the frame side wall 16 at the drive side and furthermore pivotable between an upper and a lower position about an axle 17 extending substantially parallel to the rotational axis of the associated plate cylinder 3 or 4.

25       In the end position A of each device 10 or 11, the reception and removal of the printing plates 12 and 13 is possible.

In the end position B of the device, the hooking of a bent-over start 18 of a new printing plate 12 into the channel 8 of the plate cylinder 3 takes place through upward pivotation of the guide 14 and the redisposition of the printing plate start 18 into the position C (Fig. 6a), with the cylinder 3 being disposed in a hooking-in position, i.e. with the channel 8 facing the position C. In analogous manner, the hooking of the start 18 of a new printing plate 12 into the channel 9 of the cylinder 4 takes place through the downward pivotation of the guide 15 and redisposition of the printing plate start 18 into the position D.

Unhooking of the start 18 of an old printing plate 13 out of the channel 8 of the cylinder 3 takes place in the end position B of the device 10 through a downward pivotation of the guide 14 and redisposition of the printing plate start 18 into the position E (Fig. 6b), the cylinder 3 being disposed in the hooking-out position, i.e. the channel 8 faces the position E. Analogously, unhooking of the start 18 of an old printing plate 13 from the channel 9 of the cylinder 4 takes place through upward pivotation of the guide 15 and the redisposition of the printing plate start 18 into the position F.

Each of the plate cylinders 3 and 4 is provided with a tensioning shaft 20 and a tensioning strip 21, which is firmly connected therewith and arranged to be pivotable in the channel 8 or 9 for clamping of a printing plate end 19 and for the tensioning of a printing plate around the respective cylinder. Associated with each cylinder is a contact pressure roller 24, which is rotatably

mounted in levers 22 and settable against the plate cylinder 3 or 4 by means of double-acting pneumatic piston-cylinder units 23. The roller 24 carries, near its end faces, actuating rollers 25 which, when the roller 24 is so set, stand in operative connection with switching segments 26, which are positioned in the circumferential surface of the cylinder, of spring-loaded switching levers 27. The levers 27 are rotationally fast with the tensioning shaft 20.

The switching segments 26 are so dimensioned and positioned that the effective sector corresponds to the arc of an angle limited inclusively by those angular positions of the plate cylinder 3 or 4 which are associated with the position of the detaching of the end 19 of an old printing plate 13 and the position of pressing in of the end 19 of a new printing plate 12.

In a refinement, adjusting elements can be provided to enable a slight displacement of the segments 26 for influencing the switching angle.

An incremental angle signal transmitter 28 with adequate resolution functions as position detector for sequence control during automatic plate changing.

The rectilinear guide, for example the guide 14, in the preferred embodiment consists in detail of a guide track 14.1, which is pivotable by means of the axle 17, a slide block 14.2, which is mounted to be displaceable in the guide track 14.1, a circulating ball drive with a circulating ball spindle 14.3 and circulating ball nut 14.4, a geared motor 14.5 firmly connected with the guide track 14.1 and a shaft coupling 14.6 by means of which the motor drive shaft and the spindle 14.3 are connected to each other to be secure against relative rotation.



The plate holding device 10 is pivotably mounted on side block 14.2 by means of an axle 14.7, so that an upward pivotation of the device out of the region for servicing is possible in the end position A. The device 11 is similarly pivotably mounted on the guide 15 and is pivotable downwardly for servicing.

Two double-acting pneumatic piston-cylinder drives - each drive comprising two units 29 and 30 connected with each other in opposite sense - are provided as drive means for the pivotation of, respectively, the guides 14 and 15. The piston rods are articulated at one end with the frame side wall 16 at the drive side and at the other end with a respective one of the guides 14 and 15, so that the guide can assume any one of the intended three positions through reversal of both or only one of the units 29 and 30.

Each plate holding device 10 or 11 is equipped with abutments 31 and two spring-loaded presser feet 32 and 33, one each in the side edge region of the printing plate to be held. The abutments 31 serve for exact positioning and, together with the presser feet 32 and 33, for fixing of the new printing plate 12 in the device and thereby contribute to tensioning of the printing plate true to register. The spring-loading of the presser feet 32 and 33 also allows drawing of the rolled-in printing plate end 19 out of the device 10 or 11. Felt plates mounted on the underside of the presser feet 32 and 33 prevent scratching of the plate surface. The presser foot 33 arranged at the operating side is pivotable so that laying-in of the plate from the operating side is made possible. The device 10 or 11 also has a rack 34 with a slide-in gap 35 for the removal and guiding-away of the old printing plate 13.

Each plate holding device 10 or 11 in the preferred embodiment is additionally equipped at the operating side with rollers 36 in order to support it on a running rail 38 arranged at the frame side wall 37 at the operating side.

5           In use, the automatic changing of a printing plate is controlled by a control which is programmable by a storage device, wherein the sequence is dependent on a time plan and on the reaching of certain angular positions of the plate cylinders 3 and 4 and positions of the plate holding devices 10 and 11.

10           Initially, a plate change is prepared by the printer. The device 10 for example, which has been in the end position A and pivoted upwardly during the printing, is pivoted back and a new printing plate 12 is laid in.

15           The printer can then initiate automatic plate changing by a start signal.

          According to a first part of the program sequence, the new printing plate 12 is initially conducted to the cylinder 3 and an old printing plate 13 is subsequently removed from the cylinder 3 and taken off by the device 10.

20           In a first step of this first part, the device 10 with the printing plate 12 is moved into the end position B (limited and reported by limit switches) at the cylinder 3. In a second step, the plate cylinder 3 supported on the incremental angle transmitter 28 is brought to standstill in the hooking-out position for the plate. In a third step, while the cylinder 3 stands in the hooking-out position, the contact pressure roller 24 with the actuating rollers 25 is moved against the cylinder.

In the nextstep, the cylinder 3, whilst rotating in the normal direction of rotation and supported on the angle transmitter 28, is brought to standstill in a plate release position. In this position, the actuating rollers 25 stand in contact with the switching segments 26 of the switching levers 27 and the tensioning shaft 20 with the tensioning strip 21 is pivoted to such an extent that the channel 8 is opened and the clamping of the printing plate end 19 is released. The printing plate 13, until then clamped around the cylinder 3, is relieved and the plate end 19 in that case springs into a position facing the slide-in slot 35 of the device 10. This can also be enhanced by an additional, appropriately directed leaf spring arrangement on the shaft 20.

In the following step, the cylinder 3 executes a complete revolution against the normal direction of rotation and in that case pushes the printing plate 13 almost completely into the rack 34 of the device 10, moves past the plate release position and comes to a standstill in the plate hooking-out position. In this position, the actuating rollers 25 do not stand in contact with the switching segments 26, but the plate start 18 is able to be unhooked.

Finally, in a sixth step the guide 14 is pivoted downwardly with the device 10, in which case the plate 18 is redispersed into the position E and pulled out of the cylinder channel 8.

According to a second part of the program sequence plan, the new printing plate 12 is attached to the plate cylinder 3 and the old printing plate 13 is subsequently moved away from the cylinder.

In a first step of this second part, the plate cylinder 3, again rotating in normal direction of rotation and supported on the angle transmitter 28, is brought to standstill in the hooking-in position. In this position, the actuating rollers 25 again stand in  
5 contact with the switching segments 36 of the switching levers 27 and the plate cylinder channel 8 is open.

In a second step, the guide 14 is pivoted upwardly with the device 10, the plate start 18 in that case being redispersed into the position C and hooked into the cylinder channel 8. In a third step,  
10 the printing unit is started up and the cylinder 3 rotated in normal direction of rotation. While executing the first complete revolution, the cylinder 3 draws the printing plate 12 out of the device 10 and tensions the printing plate 12 in co-operation with the contact pressure roller 24 and with the rubber blanket cylinder  
15 5 when the latter is set on. On further rotation, the plate end 19 is pressed into the channel 8 by the blanket cylinder 5. Directly after moving over the position of the pressing-in of the plate end 19 into the channel 8, the actuating rollers 25 and the switching segments 26 move out of contact and, under the effect of the spring-  
20 loaded levers 27, the plate end 19 is clamped and the plate 12 is tensioned by the shaft 20 with the strip 21.

In the next step, and still before completion of the second revolution of the cylinder 3, the contact pressure roller 24 with the actuating rollers 25 is set back. In the following step, the  
25 guide 14 with the plate feed equipment 10 is pivoted back into the middle position of the device 10 still in its end position B.

Finally, in a sixth step, the device 10 with the printing plate 13 is moved away from the cylinder 3 into the end position A (limited by limit switches).

5 Plate changing at the cylinder 4 by way of the device 11 proceeds in analogous manner, with appropriate rotation of the cylinder 4 and pivotation of the guide 15.

A particular advantage is that the automatic changing of a printing plate is also applicable for single printing units, the printing plate being to be changed with printing switched off.  
10 Moreover, accessibility to the printing unit and the region for servicing is maintained without restriction.

CLAIMS

1. A printing machine comprising at least one printing plate cylinder provided with a channel for reception of leading and trailing edge portions of a printing plate wrapped around the cylinder and with means for releasably clamping the rear edge  
5 portion in the channel and tensioning the plate around the cylinder, and respective printing plate changing means associated with the or each cylinder and comprising a plate holding device movable along a guide between a first position which is spaced from the cylinder and in which plates can be loaded into and removed from the device and  
10 a second position which is adjacent to the cylinder and in which plates can be transferred between the device and the cylinder, the guide being pivotable to move the device, when in the second position, in one direction for hooking of the leading edge portion of a plate held by the device into the channel of the cylinder and  
15 in a direction opposite to said one direction for unhooking of the leading edge portion of such a plate from the channel.

2. A printing machine as claimed in claim 1, wherein the guide of the or each plate changing means extends substantially horizontally and perpendicularly to the axis of the associated cylinder and is  
20 pivotable about an axis substantially parallel to the cylinder axis.

3. A printing machine as claimed in claim 1 or claim 2, wherein the or each means for clamping and tensioning comprises a shaft rotatably mounted in the respective cylinder and provided with a tensioning strip engageable with a plate trailing edge portion  
5 received in the channel of the cylinder.

4. A printing machine as claimed in claim 3, wherein the or each means for clamping and tensioning further comprises lever means connected to the associated shaft and pivotable to turn the shaft.

5. A printing machine as claimed in claim 4, comprising actuating  
10 means co-operable with the lever means to pivot the lever means against a resilient bias.

6. A printing machine as claimed in claim 5, wherein the actuating means comprises an actuating roller mounted on a lever arm and movable by the lever arm to press against a press portion of the  
15 lever means.

7. A printing machine as claimed in any one of the preceding claims, comprising means to detect pivoted states of the or each guide and to cause the associated cylinder to be oriented so that its channel is disposed in a predetermined position for hooking in  
20 and unhooking of leading edge portions of plates.

8. A printing machine as claimed in any one of the preceding claims, wherein the or each guide is pivotable about an axis which is so disposed that the leading edge portion of each plate to be transferred to the associated cylinder extends substantially parallel to a hooking edge of the channel of the cylinder during hooking of that edge portion into the channel.

9. A printing machine as claimed in any one of the preceding claims, wherein the or each plate holding device is provided with means for positioning and fixing plates in the device.

10. A printing machine as claimed in any one of the preceding claims, wherein the or each plate holding device is mounted in the associated guide to be pivotable into an inoperative position for servicing.

11. A printing machine as claimed in any one of the preceding claims, wherein the or each plate holding device is supported by rollable elements at wall means of the machine.

12. A printing machine as claimed in claim 6, comprising a contact pressure roller mounted on the lever arm and movable by the lever arm to press against a plate wrapped around the associated cylinder.

13. A printing machine as claimed in any one of the preceding claims, comprising two such plate cylinders disposed one above the other in a four-cylinder printing unit.



14. A printing machine substantially as hereinbefore described with reference to the accompanying drawings.

**Patents Act 1977****Examiner's report to the Comptroller under Section 17  
(The Search report)**Application number  
GB 9413301.4**Relevant Technical Fields**

- (i) UK Cl (Ed.N)      B6C: CKW, CMB, CMC  
(ii) Int Cl (Ed.5)      B41F: 27/00, 27/06, 27/12, 27/14

Search Examiner  
A DAVEYDate of completion of Search  
**12 OCTOBER 1994****Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-  
1-14

(ii) ONLINE DATABASE: WPI

**Categories of documents**

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Category	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0582903 A (MAN ROLAND) whole document	1
X	US 5289775 (HEIDELBERGER) see eg Figures 3, 4	1

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